REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

Claims 1-18 are in this case. Claims 1-18 have been rejected under § 102(b) or § 103(a). Claims 1-18 have been further rejected under the judicially created doctrine of obviousness-type double patenting, as being unpatentable over claims 1, 4-7, 12, and 17 of U.S. Patent No. 6341782, or over those claims and in view of common knowledge of the art and/or engineering design choice. Claims 1-18 have been canceled, without prejudice. New claims 19 - 37 have been added.

§ 102(b) Rejections

The Examiner has rejected claims 1, 7, 12, and 15-18 under § 102(b) as being anticipated by Etsion '080 (U.S. Patent No. 5952080). The Examiner's rejections are respectfully traversed.

While both the instant invention and Etsion '080 teach hydrodynamic bearing surfaces having micropores, the modes of operation are completely different. In Etsion '080, the micropores are evenly distributed over the entire "bearing" surface and are disposed at a distance from each other. In this case, there is – deliberately -- no interaction between neighboring micropores, rather, each micropores acts as an individual micro-hydrodynamic bearing when relative sliding takes place between the mating parallel surfaces of the "bearing". This configuration provides a small load capacity between the mating surfaces, hence, the primary application is in seals, where small clearance is an essential criterion for good sealing.

By sharp contrast, the instant invention teaches an efficient hydrodynamic bearing with high load capacity and a much larger clearance as compared with the art disclosed by Etsion '080. The mechanism is not an "individual effect" of a plurality of micropores acting as individual micro-hydrodynamic bearings, but rather, a "collective effect" of the micropores, so as to provide an equivalent converging clearance in the relative sliding direction of the bearing surfaces.

The results achieved using the "collective effect" of the instant invention are surprising indeed, as shown inter alia in instant Figure 5, and as described in the associated text:

> The dimples in the partial texturing case have an area density S_p=0.5 and, as is clearly seen from proximity of the dimples, neighboring dimples strongly affect one another ("collective dimples effect"). The collective effect results in a step-like pressure distribution over the textured portion of the slider with a maximum dimensionless pressure p=275 at $x=B_p$=15 corresponding to α=0.6. The dimples in the full texturing case do not interact (an individual dimple effect), resulting in a periodic pressure distribution with local cavitation zones (p=0). The optimum area density of the dimples in this case for maximum pressure and load capacity was S_p=0.13 and the maximum local pressure in this case is p=75.
> (page 11, line 34 – page 12, line 6)

It must be emphasized that the full texturing case is the optimal case for the prior art taught by Etsion '080. By sharp contrast, the partial texturing case, in which only 60% of the bearing surface has micropores disposed therein, attains a maximum dimensionless pressure that is more than 3.5 times the maximum dimensionless pressure of the bearing surface of the prior art.

Because the physical mechanism of the inventive bearings is radically different from the physical mechanism of the bearings disclosed by Etsion '080, it

was far from obvious, prior to modeling, developing and solving the equations, and experimental testing, that the bearing surfaces of the instant invention would even work, let alone provide superior performance to the cited prior art.

It must be emphasized that original claim 1 recites the following limitations:

> wherein at least one of said surfaces is a micropore-containing surface having a plurality of micropores, said plurality of micropores disposed so as to effect an equivalent clearance convergence between said surfaces, in a direction of said relative motion, such that said relative motion, acting on said fluid, generates a pressure so as to generate a lifting force between said surfaces.

The term "equivalent clearance convergence" is defined in the instant Specification as follows:

> As used herein in the specification and in the claims section that follows, the term "equivalent clearance convergence" and the like refers to an average reduction in the clearance between the opposing bearing surfaces. The term is specifically meant to include nominally-parallel bearing surfaces having micropores distributed so as to provide an equivalent clearance convergence effect.

Applicant steadfastly maintains that the micropore-textured hydrodynamic bearings of Etsion '080 do not have an "equivalent clearance convergence". It is further manifest that the micropore-textured hydrodynamic bearings of Etsion '080 do not have an "equivalent clearance convergence in a direction of said relative motion". This point is supported by the Affidavit of Professor Izhak Etsion under 37 CFR 1.132, appended hereto.

While continuing to traverse the Examiner's rejections, the Applicant has, in order to expedite the prosecution, chosen to cancel independent claim 1 and to compose new independent claim 19 and new dependent claims 20-37, in order to

clarify and emphasize the crucial distinctions between the device of the present invention and the known prior art, including the Etsion'080 patent cited by the Examiner.

§ 103 Rejections

The Examiner has rejected claims 2-6, 8-11, and 13-14 under § 103(a) as being unpatentable over Etsion '080, and further in view of official notice of common knowledge in the art, and/or, in the alternative, engineering design choice.

The Examiner finds that it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the additional feature(s) in question since it was known in the art to do so to provide the function(s) disclosed.

Alternatively or additionally, the Examiner finds that the broad provision of this/these features *vis-a-vis* that/those disclosed by the reference solve(s) no stated problem insofar as the record is concerned and, accordingly, would have been an obvious matter of design choice. See *In re Kuhle,* 526 F.2d 553, 188 USPQ 7 (CCPA 1975).

The Examiner's rejections are respectfully traversed. The vast differences between the art taught by Etsion '080 and the instant invention have been articulated hereinabove. Briefly, because the physical mechanism of the inventive bearings is radically different from the physical mechanism of the bearings disclosed by Etsion '080, it was far from obvious, prior to modeling, developing and solving the equations, and experimental testing, that the bearing surfaces of the instant invention would even work, let alone provide superior performance to the cited prior art. This point was developed in the instant Specification:

> there exist a plethora of parameters that influence the load carrying capacity of parallel sliders. These parameters, provided in dimensionless form, include:
>
> | | |
> |---|---|
> | Dimensionless treated portion of the slider: | α |
> | Dimple aspect ratio: | ε |
> | Dimensionless clearance: | δ |
> | Cell aspect ratio: | κ |
> | Area density of the dimples: | S_p |
> | Slider length over width ratio: | L/B |
> | Dimensionless slider width: | B |
>
> **Hence, even if it were known that LST may be potentially appropriate for thrust bearing applications, it would certainly be beyond the realm of one of ordinary skill in the art to design a functional, practicable thrust bearing, a design that must take into account, inter alia, various physical properties of the individual micropore, the position and area density of the micropores on the bearing surface(s), and the duty and dimensions of the bearing.** (pages 2-3) [emphasis added]

Thus, above and beyond the fundamental patentability arguments presented hereinabove with respect to the § 102 rejections, it is respectfully submitted that the design parameter limitations, as claimed, cannot be learned from the cited prior art, and cannot be considered to be obvious matters of design choice.

Moreover, these design parameters cannot be determined by routine testing, even by experts in the art. This point is further developed in the above-referenced Affidavit of Professor Izhak Etsion.

Specifically, Etsion '080 explicitly teaches that "the pores are evenly distributed with an area ratio that is no more than 30% of the surface area of seal ring **14**..." (column 3, lines 50-51), and the experimental findings provided (column 6, lines 1-40) are for a surface coverage of 20% or 30%.

By sharp contrast, original claims 13-14 recite a limitation that the area ratio exceeds about 0.4 and 0.5 (i.e., 40% and 50%), respectively. Surprisingly superior results for the higher value of area ratio are provided, inter alia, in Figures 5, 7 and 8.

Original claims 9-11 recite a limitation that the dimensionless treated portion of the bearing surface, α, is between 0.2 to 0.9, between 0.3 and 0.8, and between 0.5 and 0.7, respectively. Significantly, Etsion '080 teaches that that the bearing surface is completely treated, i.e., $\alpha = 1$, as shown in Figure 2 and as described in the associated text. In Figure 6 of the instant invention it is shown that under the specified conditions, the load capacity at $\alpha = 0.9$ is 3-4 times the load capacity at $\alpha = 1.0$; the maximum load capacity at $\sim\alpha = 0.6$ is close to 20 times the load capacity at $\alpha = 1.0$. Thus, Applicant steadfastly maintains that the surprisingly superior results are not taught, nor fairly suggested by the cited prior art.

Obviousness-Type Double Patenting Rejections

Claims 1-18 have been rejected under the judicially created doctrine of obviousness-type double patenting, as being unpatentable over claims 1, 4-7, 12, and 17 of U.S. Patent No. 6341782, or over those claims and in view of common knowledge of the art and/or engineering design choice.

Claims 1-18 have been canceled, without prejudice. However, as argued hereinabove, original claims 1-18 are patentably distinct from the cited prior art, as are new claims 19-37. Applicant notes in passing that independent claim 1 of U.S. Patent No. 6341782 is limited to nominally parallel surfaces, and does not recite the limitations of "equivalent clearance convergence between said surfaces in a direction of said relative motion". Independent claim 12 of U.S. Patent No. 6341782 is a

hydrostatic seal, not a hydrodynamic seal, and does not recite the limitations of "equivalent clearance convergence between said surfaces in a direction of said relative motion". Moreover, the lifting force is hydrostatic, and is induced by a radial pressure differential, which is manifestly different from the instant hydrodynamic bearing in which "relative motion, acting on a fluid disposed between said surfaces, generates a pressure so as to generate a lifting force between said surfaces". Thus, new claims 19-37 are patentably distinct from the claims cited by the Examiner.

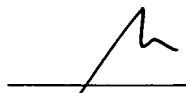
Therefore, the Examiner is respectfully requested to reconsider and withdraw the rejection under the judicially created doctrine of obviousness-type double patenting.

New Claims

Support for new claims 19-37 can be found in the Specification. Specifically, claim 19 draws support from original claim 1. Claim 20 draws support from Figs. 2 and 3 and the associated text. Claims 21, 22 and 24 draw support from Figs. 1 and 12a-12d. Claims 23, 26-33, and 36-37 draw support from original claims 14, 10, 11, 13, 2-5, 7, 15 and 18, respectively. Claim 25 draws support from Figs. 12b and 12d and the associated text. Claims 34 and 35 draw support, inter alia, from Figure 1 and Figure 13 and the associated text.

In view of the above amendments and remarks it is respectfully submitted that claims 19-37 are in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,



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